**CONCEPT- MECHANISMS OF EVOLUTION**

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**BACKGROUND INFORMATION** 

Evolution is defined in dictionary as a gradual process in which something changes into a different and usually more complex or better form. In the world of biology that something is ‘population’ not the individual. . A ‘**population’** is an interbreeding group of individuals of one species in a given geographic area. Biological

Evolution is a process that results in heritable changes in a population spread over many generations.  Evolution helps us to understand the history of life. Therefore evolution is defined as descent with modification.

The speed and direction of change is variable with different species lines and at different times.  Continuous evolution over many generations can result in the development of new varieties and species.  Likewise, failure to evolve in response to environmental changes can, and often does, lead to extinction.

As a result of the massive amount of evidence for biological evolution accumulated over the last two centuries, we can safely conclude that evolution has occurred and continues to occur.  All life forms, including humans, evolved from earlier species, and all still living species of organisms continue to evolve today.  They are not unchanging end-products.The evidence for evolution has primarily come from four sources:

1. the fossil record of change in earlier species

2. the chemical and anatomical similarities of related life forms

3. the geographic distribution of related species

4. the recorded genetic changes in living organisms over many generations

There are different mechanisms of evolution that are responsible for evolution. These are genetic recombination, mutation, Genetic drift, Gene flow, natural selection (including sexual selection, kin selection), and artificial selection,. Some of these alter the gene and frequency of gene in gene pool. Others determine the faith of those altered genes.

**ADVANCE PREPARATION**-

Teacher has to prepare the students work sheet, instruction sheet, make photocopies, and check the computer stations before activities. Check Projector..

**SPECIAL MATERIALS** 

student work sheets and instruction sheets, computer, access to internet for Gizmo, Materials for performing clip bird activity, dog breeding activity and bottle neck effect- different size binder clips, food or birds, pennies, Ziploc bags, paper cups, plastic or glass bottles, different colour beads playing cards, Projector.

**SAFETY**

1. Simulations are best conducted under low light conditions. Students should remain at their lab stations while light levels are low.

2. Beads are a hazard if dropped on the floor. Students can easily trip on round beads. Ensure that student pick up any dropped bead immediately.

3. Require accounting for all items supplied to prevent any items from remaining on the site. This requirement conserves resources and prevents harms to other using the site.

**STUDENT’S MISCONCEPTIONS** **AND RECTIFICATIONS**  

**MISCONCEPTION#1 Evolution results in progress; organisms are always getting better through evolution.**

**RECTIFICATION** natural selection does not produce organisms perfectly suited to their environments. It often allows the survival of individuals with a range of traits — individuals that are "good enough" to survive.

**MISCONCEPTION#2 Individual organisms can evolve during a single lifespan.**

**RECTIFICATION** Evolutionary change is based on changes in the genetic makeup of populations over time. Populations, not individual organisms, evolve. Changes in an individual over the course of its lifetime may be developmental (e.g., a male bird growing more colourful plumage as it reaches sexual maturity)

**MISCONCEPTION#3Natural selection is about survival of the very fittest individuals in a population.**

**RECTIFICATION** Though "survival of the fittest" is the catchphrase of natural selection, "survival of the fit enough" is more accurate. The individuals may not be the "fittest" in the population, but they are "fit enough" to reproduce and pass their genes on to the next generation

**MISCONCEPTION#4Natural selection produces organisms perfectly suited to their environments.**

**RECTIFICATION-** Natural selection is not all-powerful. There are many reasons that natural selection cannot produce "perfectly-engineered" traits. For example, living things are made up of traits resulting from a complicated set of trade-offs — changing one feature for the better may mean changing another for the worse (e.g., a bird with the "perfect" tail plumage to attract mates maybe be particularly vulnerable to predators because of its long tail).

**MISCONCEPTION#5** **“Natural selection involves organisms ‘trying’ to adapt.”**

**RECTIFICATION-** Natural selection leads to adaptation, but the process doesn’t involve “trying.” Natural selection involves genetic variation and selection among variants present in a population. Either an individual has genes that are good enough to survive and reproduce, or it does not—but it can’t get the right genes by “trying.”

# MISCONCEPTION#6 “Natural selection gives organisms what they ‘need. ”

# RECTIFICATION -Natural selection has no intentions or senses; it cannot sense what a species “needs.” If a population happens to have the genetic variation that allows some individuals to survive a particular challenge better than others, then those individuals will have more offspring in the next generation, and the population will evolve. If that genetic variation is not in the population, the population may still survive (but not evolve much) or it may die out.

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# MISCONCEPTION#7Genetic drift only occurs in small populations.

# RECTIFICATION- Genetic drift has a larger effect on small populations, but the process occurs in all populations — large or small. However, in large populations, the changes in gene frequency from generation to generation tend to be small.

**LESSON SEQUENCE**

Lesson-I Introduction- evolution survey, brief review, Video, concept overview and vocabulary.

Lesson-II Genetic recombination, Mutation and Non random mating

Lesson-III Genetic drift, bottleneck effect, founder effect, Gene flow and Biotechnology

Lesson-IV Natural selection, stabilizing selection, disruptive selection, directional selection.

Lesson-V Special forms of Natural selection, Sexual selection, Kin selection, cumulative selection

Lesson-VI Artificial selection

**TEACHING IDEAS**    

Mechanisms of evolution are difficult to demonstrate in class therefore using visual aids and activities is very important. Exposing students to variety of documentaries and activities (classroom and simulation) will help them to visualise the concept. To make them understand the implication of these processes case study approach could be used. If possible visit to museum is a great idea.

**EVALUATION PROCEDURES-**

Assessment For Learning – Diagnostic test to find out Misconceptions.

Assessment AS Learning- Observation, Questioning, Assessing Students’ worksheet after classroom and online activities.

Assessment Of Learning- paper-pencil test

**APPLICATIONS AND SOCIETAL ISSUES-**

Understanding evolution helps us solve biological problems that impact our lives. An understanding of evolution of drug resistance, origin of disease and processes of evolution may provide clues about how to treat them. Knowledge of genetic variation and evolutionary relationships helps farmers improve the ability of crops to resist disease. An understanding of how pesticide resistance evolves can provide strategies to minimize pest damage. It can also help conservationists make decisions about where to focus their efforts for conservation of endangered species.

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